advance since the invention of the chronometer has been the application of wireless telegraphy, of which the possibilities began to be considered in this connection very soon after Marconi's first success.

Few unexplored districts of the habitable globe would be beyond the reach of a powerful wireless installation if distributing stations were an ordinary adjunct of every national observatory, and it is likely that the network of stations will be able to distribute Greenwich time over the whole of the oceans.

For general purposes time-determination within a quarter of a second is sufficiently exact, but this accuracy at a fixed observatory was by no means always attainable under old conditions, since a week of cloudy skies, especially if accompanied by considerable changes of temperature, would leave the fixed observatory almost as dependent on the rate of a chronometer as a ship at sea. Here, however, the new development steps in and suggests that, since it is not likely to be cloudy everywhere, the time can be checked by that of an observatory perhaps thousands of miles away; so that no error approaching a second of time need be feared.

This state of things, needless to say, is not yet universal; but there is no doubt about the beginning that has been made. The distributing stations, requiring great electrical power and much more costly and elaborate fittings, will always be comparatively few, but the receiving stations can also take part in the scheme. The Eiffel Tower station sends out the Paris Observatory determination of Greenwich mean midnight, for instance, and this is received, say, at Greenwich with a modest equipment and compared with the Greenwich determination. The difference can be sent without much delay to Paris by post or telegram. When it is remembered that at night, under favourable conditions, signals from the Eiffel Tower have been received at a distance well above 3000 miles (5200 kilometres), it will at once be seen how this device will prevent any accumulation of error due to a spell of bad weather.

But a quarter of a second cannot be regarded as indicating the possible limit of accuracy attainable. By employing clocks with a small difference of rate, coincidences of beat can be noted with great accuracy, the arrangement forming what might be called an acoustic vernier. For example, if two sidereal clocks supposed to be synchronised differ by a small fraction of a second owing to a difference of lag in taking up the current from the control clock, this difference can be readily obtained by comparing each with the same mean solar clock, as the coincidences will occur at a definite interval. An accuracy of one-hundredth of a second (to use a loose, convenient phrase) is not by any means impossible in this way, and Commandant Ferrié suggests one-thousandth of a second as practicable. In this way may be measured not only the lag between the clock beat and the closing of the transmitting circuit, the additional lag before the Hertzian waves actually leave the Eiffel Tower, and the lag at the receiving station, but also the velocity of the waves themselves, which can be measured, he says, with an error of less than 3 per cent., though this velocity nearly reaches 200,000 miles per second.

It is part of the routine of the station to transmit time-signals by night and by day, the latter being followed by a meteorological report giving barometric pressure, direction and force of the wind, and the state of the sea for six stations in and around the Atlantic. Similar work, at times arranged not to interfere with that of the Eiffel Tower, is done at the German station at Norddeich, and other extensions will doubtless follow. Japan, at any rate, has already started an independent system.

Commandant Ferrié's account gives very full mechanical details of each step of the process, and should be of great interest to the growing number of people possessing private wireless installations, some of whom compare their time almost daily with both Eiffel Tower and Norddeich. There is no indication at present of any intention to erect a distributing station at Greenwich, and, as stated above, it may be considered unnecessary, the fortuitous presence of the Eiffel Tower giving Paris a great advantage, as its range goes far beyond the British Isles.

W. W. B.

NOTES.

THE exhibition of specimens illustrating the modification of the structure of animals in relation to flight which has been in preparation for many months at the Natural History Museum will be open to the public on Friday, August 15. It occupies the fourth bay on the right of the central hall, and comprises 166 mounted objects and twelve microscopic specimens for the purpose of elucidating the subject in a popular manner. The adaptation of each kind of flying animal for aërial locomotion is explained, and the changes that must have taken place in the structure of the body before the animal could really fly are indicated, and attention is directed to the remarkable fact that the power of flight has been evolved independently in different groups of animals—*e.g.* bats, birds, Pterodactyles, and insects.

THE death is announced, in his fifty-first year, of Prof. Edwin Goldmann, honorary professor of surgery in the University of Freiburg i/B. since 1892. Prof. Goldmann's scientific career and work are referred to in an appreciative notice contributed by Prof. Ehrlich to *The Times* of August 13, and here summarised:—As a pupil and friend of the famous pathologist Weigert, he mastered the technique of microscopy completely. In early days he busied himself principally with researches into biochemistry. Here he turned his attention especially to the study of minute vascular changes. And then an inner impulse compelled him to devote himself to the important field of cancer research, and by ingenious experiments to advance our knowledge of this difficult problem. His great work with a large number of instructive illustrations set in a right light the significance of cell division for biology and the spread of cancer; and afforded far-reaching insight into the complicated means of curing tumours. He reached the summit of his work in the last few years, during which he prosecuted his studies, which must be regarded as classical, in the staining of living tissues. Goldmann recognised clearly that if we desire to know and study the functions of the living cell the staining of living tissues offers the most profitable means. There were previously only a few works dating from an older generation, such as those on methylene blue, but they, corresponding to their own time, followed an incomplete technique. Here came in Goldmann's work. He succeeded in discovering a method of carrying out an exact pursuit of *intra vitam* staining in microscopic sections. The staining material, pyrrol blue, possesses the peculiarity of colouring a very special kind of cells which are found in the connective tissue and of making them visible to the eye, while the dye allows certain round granules contained in these cells to show up distinctly and in an intensive blue. Now Goldmann was able with the help of his method completely to clear up the great significance of the function of these cells, and to show that both in normal functions, as, for example, in digestion, and also in the majority of disease derangements, as in the case of tuberculosis and carcinoma, they play a very important part. His last important work also, "Ueber die Vitalfarbung am Centralnervensystem," dealt with that method and arrived at important conclusions concerning the nutrition of the central nervous system and the circulation of the cerebro-spinal fluid.

PROF. H. C. JONES, professor of physical chemistry at the Johns Hopkins University, has been awarded the Edward Longstreth medal of the Franklin Institute of Philadelphia for his work on the nature of solutions.

THE inaugural address at the re-opening of the School of Pharmacy in October will, by invitation of the Pharmaceutical Society, be delivered by Dr. F. B. Power, director of the Wellcome Research Laboratories. On the same occasion Dr. Power will be presented with the Hanbury medal.

THE Paris correspondent of *The Times* announces that the expedition to Franz Josef Land, under the command of M. Jules de Payer, left Havre on August 10. The object of the expedition is to explore the little-known north-eastern corner of Franz Josef Land, and a programme of scientific work has been prepared. The base will be established in Zichy Land.

PROF. CHARLES F. MARVIN, professor of meteorology to the U.S. Weather Bureau, has been appointed to succeed Mr. Willis L. Moore as chief of that bureau. The new head of the office has been in the Government service since 1884, and is widely known for his important meteorological investigations. It is announced that under the new administration the Weather Bureau will pay greater attention to such weather reports and forecasts as are likely to affect agriculture.

THE fifth annual conference of the National Association for the Prevention of Consumption was opened by the Prime Minister at the Central Hall, Westminster, on August 4, Lord Balfour of Burleigh presiding. A considerable portion of the session was occupied with a discussion on tuberculin treatment, in which Dr. H. W. G. Mackenzie, Prof. Sims Woodhead, Prof. Sali, and Dr. Lydia Rabinowitsch took part. On August 5 Sir R. W. Philip delivered an address on the need for coordination of anti-tuberculosis measures, which evoked an interesting discussion.

OFFICIAL tests of a system of wireless telephony invented by a Japanese electrician, Mr. Torikata, have led to the adoption of the system by the Japanese Government, which has ordered all the shipping companies subsidised by it to install the apparatus on their principal vessels. The instructions have already been followed by the three largest Japanese mail steamship lines, we learn from *The Japan Chronicle* (July 17), with eminently satisfactory results. Patent rights for the invention have been secured in Japan, England, and France, and others are pending in Germany and the United States. It is stated that the present range of audibility of the Japanese system is sixty miles. The advantage claimed for the apparatus over competing systems is its simplicity, it being no more difficult to use than an ordinary telephone.

ASAMA-YAMA, the well-known Japanese volcano, has again been displaying great activity. On June 17, reports the Tokyo *Asahi*, an eruption occurred which is believed to be the most violent on record. Dense black clouds rose to a great height above the crater, and two streams of lava poured forth, one flowing towards Rogome Station, on the south, and the other invading the forest in Kita Saku district, on the west. Further eruptions occurred on June 20 and 26. A heavy fall of volcanic ash, lasting three hours, took place on the former date at Takazaki, thirty miles east of the volcano. On June 26 Dr. Omori, the distinguished Japanese seismologist, with a party of assistants, ascended the volcano with the view of investigating the conditions, but found advance beyond the ninth stage impossible. The party retired to the observatory at the base, intending to await a favourable opportunity of reaching the summit. Several cracks appeared in the upper half of the volcano, from which issued volumes of dust and vapour, and there were indications that a new crater is forming.

WE announce with regret the death, as the result of an aëroplane accident, of Mr. S. F. Cody, the well-known airman, while flying with a passenger near Aldershot on August 7. The machine the collapse of which caused the accident was the new large biplane which Mr. Cody had built for the purpose of competing in the coming waterplane race round Great Britain. It was as a kite-flyer that Cody first came into prominence. In 1903, after two failures, he all but succeeded in crossing from Calais to Dover in a collapsible 14-ft. boat drawn by a kite. In 1906 the War Office appointed Cody chief instructor in kite-flying. In 1907 he was largely responsible for the engineering work of the Army airship, *Nulli Secundus*. In 1909 he achieved a cross-country flight of forty miles in sixty-three minutes—a record at the time. Cody was born in 1862, and was in his forty-seventh year when he began his experiments with flying machines. At the time of his death he was building a triplane on which he proposed to try to cross the Atlantic.

To the large collection of the contents of "short stone cists" found in the north-east of Scotland, and displayed in the anatomy museum of the University of Aberdeen, there have been added recently the contents of two others. One was found at Ellon, Aberdeenshire, and the other at Burgie, Morayshire. Both cists lay in elevated gravelly situations, with no external marks or monuments to indicate their positions, and had their long axes directed from east to west. Their roofs and walls were composed of large flat stones indigenous to the parts of the country in which they were found, and their floors of a layer of sand in which pebbles were embedded. The Ellon cist measured (inside) 3 ft. 4 in. by 2 ft. 1 in. by 17 in. deep, the Burgie cist 3 ft. by 1 ft. 10 in. by 2 ft. deep. The former cist contained a fully formed male human skeleton, showing characters ordinarily met with in skeletons found in short cists, viz., stature about 5 ft. 5 in., round skull, short broad face, narrow orbits, and rather wide nose. To its right lay the much-decayed remains of the skeleton of a person from fifteen to twenty years of age. In the cist at Burgie were found remains of a fully formed human skeleton, much decomposed, the skull of which had been so injured after the cist had been found that no observations could be made from it. In both cists the skeletons had been buried in a crouching position. An urn of the "drinking-cup" variety and a flint scraper were found in the Ellon cist, but nothing beyond skeletal remains in the Burgie one.

The special feature of the present summer is the general dullness of the weather, with which is also necessarily associated a persistent low day temperature. Greenwich this year has the least sunny July on record since the registration of sunshine has been established, and although since August opened the weather has been somewhat brighter, still, many days have been very dull. Only one day at Greenwich has had the mean daily temperature in excess of the average from July 1 to August 11, a period of six weeks, and the highest maximum temperature observed is 76°, on July 12. Notwithstanding the cloudy character of the summer, there has been remarkably little rain, and prior to August 9 a drought had occurred in many parts of the British Isles. At Greenwich no rain fell from July 22 to August 6, a period of sixteen days; at Bath there was no rain for seventeen days, and at Nottingham for eighteen days. For the first sixty-eight days of summer from June 1 to August 7 the aggregate rainfall at Kew is 47 per cent. of the average, and at Greenwich 61 per cent. For the corresponding period in other parts of England Bath had only 20 per cent. of the average, Jersey 27 per cent., Nottingham 33 per cent., Liverpool 65 per cent., and Dover 68 per cent. In Scotland Leith had only 32 per cent. of the average rain and Wick 59 per cent., whilst in Ireland Valencia had 57 per cent., and Birr Castle 68 per cent. Rain has now fallen in many parts of the British Isles, but in places the conditions continue dry.

Mr. C. Robinson, writing from Lancaster, says that while walking along a grassy path near some trees on a dark night he saw, "gleaming out of the darkness at my feet, what might have been a piece of frosted silver reflecting moonlight." Upon picking up the object he found it was a piece of decayed wood, which he took away with him, but was disappointed to find afterwards that the wood had lost its luminosity. The phosphorescence of decaying wood is not an unusual phenomenon, and is frequently due to the mycelium of a fungus which permeates the wood of old tree-trunks, and has the property of emitting light under the same conditions as those of respiration. When the wood is taken away from its natural surroundings, the luminosity disappears because the relations and conditions of life of the fungus are not the same as before.

In his lecture on the pygmies of New Guinea recently delivered at the Royal Institution, Capt. C. G. Rawling gave a full account of the expedition organised by the Ornithologists' Union, assisted by the Royal Geographical Society, which left England in 1909 to explore the south-west coast of Dutch New Guinea. He sums up the results as follows:—Large and valuable collections of birds, mammals, reptiles, butterflies, and moths, with botanical and ethnographical specimens, have been made; a new and hitherto unknown race of pygmies was discovered, studied, measured, and photographed; a range of mountains, containing the greatest precipice in the world, together with 3000 miles of country, have been surveyed and mapped; new snow mountains and great rivers were found and explored; a long stretch of coast-line was surveyed. This, the longest cross-country journey ever undertaken in Dutch New Guinea, has proved the impossibility of the Mimika River as a line of advance to the snows, and, on the other hand, the value of the great rivers to the east, if an expedition in the same direction is again contemplated.

Certain human bones discovered in 1911 by Mr. Hiram Bingham in gravel near Cuzco, Peru, have been considered to indicate the existence of man in that country between 20,000 and 40,000 years ago. In an article in the July number of *The American Journal of Science,* Mr. G. F. Eaton, who has visited the spot, states that the associated remains are essentially of a modern type, including, as they do, bones of domesticated cattle. He therefore concludes that the bones were buried some time "during the three centuries and a half that have elapsed since the Spaniards brought domestic cattle to Peru." In a second article in the same issue, Mr. H. E. Gregory states that although his investigations on the spot do not definitely disprove the theory of the great age of the bones, yet "the geologic data do not require more than a few hundreds of years as the age of the human remains found in the Cuzco gravels."

If we may judge from a report on their breeding in that State, published in the Bulletin of the Illinois

State Laboratory of Natural History, vol. ix., art. 7, carp seem much more highly esteemed as food-fishes in those parts of the United States where they have been introduced than in this country. Their greatest enemies are garpike, which attack the young, and a fungus which infests the spawn, and against the ravages of these two foes remedial measures are suggested by Dr. S. A. Forbes in the article cited.

THE King has presented to the British Museum (Natural History) a tiger shot by himself in the Nepal tarai during his Majesty's tour in India in the winter of 1911–12. The specimen, which was mounted by Rowland Ward, Ltd., has been placed on exhibition in a special case on the second floor of the building, between the Banks statue and the upper mammal gallery, opposite a portion of the Hume collection of Indian big-game heads. The animal is set up in a partially crouching attitude on artificial groundwork amid real Indian jungle-grass.

ACCORDING to the sixth annual report (for 1912) of the American Bison Society, the number of pure-blooded bison in the United States and Canada increased during the season 1911–12 from 2760 to 2907 head. At the instigation of the society the U.S. Government has allocated a tract of 15,000 acres in South Dakota and the adjacent States to form an additional bison-preserve. As it includes part of the winter feeding-grounds of the great herds of bison that formerly ranged to the north and north-east, it ought to be admirably suited for the purpose.

IN spite of several more or less well-attested instances of such an occurrence, there is a very general tendency to refuse to believe that female mules may occasionally be fertile. A case recorded in *The Field* of August 2, by Mr. G. J. Harvey, Government Veterinary Surgeon at Nicosia, Cyprus, seems, however, to be beyond reasonable doubt. In this instance the mule, which is stated to have given birth to another foal a year previously, was seen by Mr. Harvey in the act of suckling her foal, then two months old. The parent, which stood 13·2 hands, is stated to be the offspring of a she-ass by an unknown sire, and certified to be an undoubted mule.

THE brown discoloration and unpleasant flavour acquired by peaches shipped for long distances has been attributed to so-called "ice-scald." That this injury is not a temperature effect is shown by recent experiments by Mr. G. R. Hill (Cornell University Agricultural Experimental Station, Bulletin 330), and evidence is adduced indicating the harmful effect to be due to an accumulation of carbon dioxide within the paper wrapper round the fruit during transit. During the investigations it was found that growing tissues, such as green peaches and germinating wheat, respire more than twice as rapidly aërobically as anaërobically, whilst ripe fruits respire as actively anaërobically as aërobically. Ripe apples lose their colour, texture, and flavour, and assume the qualities of half-baked apples by being kept for a sufficient length of time in oxygen-free gases. The softening of peaches (hydrolysis of pectose) appears to be decreased greatly by carbon dioxide and to a considerable extent by hydrogen and nitrogen; under similar conditions the fruit becomes brownish, and acquires a very bad flavour. Good ventilation and refrigeration, therefore, would appear to be the essential conditions under which this fruit should be stored.

A FURTHER report on the Isle of Wight bee disease has been issued as Supplement No. 10 to the Journal of the Board of Agriculture. Of the various sections of the report the first is contributed by Drs. Fantham and Porter, and deals with the life-history of the parasite (*Nosema apis*), with parasite carriers, examination of pollen, honey, and wax, and of certain insects found in hives; the second section, by Dr. Graham-Smith and Mr. Bullamore, describes results of infection experiments with the parasite, the mode of spread, and the means of treatment and prevention. The bacteriology of the disease is reviewed by Dr. Malden, and a summary of the investigations forms the last section. Up to the present no curative measures have been found, but certain preventive measures have yielded satisfactory results. No species of bacteria constantly associated with the disease has been found, and *B. pestiformis apis*, which is frequently in diseased stock, and was at one time thought to be the causal agent, is not pathogenic in pure culture. Bacteria, however, may play an important secondary part in producing the symptoms when the resisting powers have been lowered by the action of Nosema.

MR. G. RICCHIERI has contributed a lengthy summary of recent work on the nature of the earth's interior to the "Miscellanea di Studi" (R. Accad. Scien. Letter. di Milano). The conclusions of mathematicians and hypotheses of mathematicians, seismologists, and geologists are generally given in detail; but an account can scarcely be held complete which refers for the Rev. O. Fisher's views to the article on geology in the ninth edition of the "Encyclopædia Britannica," and omits all reference to the work of Dr. Milne and the deductions of Mr. R. D. Oldham.

IN a paper communicated to the R. Accademia dei Lincei, Dr. G. Agamennone describes an interesting spurious earthquake caused by the sudden fall in Rome of a wall 60 metres long, 20 metres high, and 1·25 metres in mean thickness. The resulting shock was sensible to man at a distance of 350 metres, and it was recorded by a seismograph at the Collegio Romano, about 700 metres from the fallen wall. The maximum amplitude of the movement was only 0·005 mm., and this was attained two or three seconds after the beginning; the period of the vibrations was about one-third of a second, whereas in earthquakes of near origin the period is rarely less than one second.

THE meteorological charts of the North Atlantic and North Pacific Oceans, issued by the U.S. Weather Bureau, for August, contain instructive articles by Mr. W. E. Hurd on the formation and movements of tropical cyclones. Several physical causes play a prominent part in their formation, but heat and moisture are necessary conditions. Mr. Hurd refers in detail to the works of various investigators, including such well-known names as Viñes, Meldrum, Algué, and others; to the variation of the storms with time and place; to their tracks and rates of progression of the vortices; the whole of which will repay careful perusal. Actual reference is not made to the article on the same subject in the valuable "Barometer Manual" issued by the London Meteorological Office, which epitomises the results of observations and experience extending over many years. A glance at this work, in conjunction with Mr. Hurd's compilation, explains how in either hemisphere the wind travels round the cyclonic centre in a direction contrary to the apparent diurnal course of the sun, the westerly wind being therefore always found in the portion of the whirl nearest to the equator. The average rate of progression (irrespective of the wind-force in the whirl) varies from about 300 miles a day in the West Indies to from fifty to 200 miles in the southern Indian Ocean. Fassig found that in the West Indies the average daily rate further increased after the recurve of the storm.

THE *Ergebnisse der magnetischen Beobachtungen* of the Royal Observatory of Wilhelmshaven for the year 1911, in addition to valuable information about magnetic diurnal and secular variation at Wilhelmshaven, contains an elaborate discussion by Prof. Bidlingmaier of what he calls "die erdmagnetische Aktivität." By "activity" he means a more exact numerical measure of the energy of magnetic forces than is afforded by the present international scale, which assigns 0 to a quiet, 1 to a moderately disturbed, and 2 to a highly disturbed day. Prof. Bidlingmaier's introductory remarks on the theoretical side are of extreme generality, but practically he assumes the "activity" for a given interval of time in a magnetic element to be proportional to the mean square of the differences of its values taken at a large, theoretically infinite, number of equidistant times throughout the interval from the mean value during the interval. By summing the "activities" for three rectangular components one would have a measure of the total "activity." The interval of time may be the hour, the day, or the year. In the first case, in practice, Prof. Bidlingmaier seems to approve of values at six-minute intervals. The labour involved in arriving at hourly "activities" throughout the whole year being very great, an attempt was made to see whether the "activity" in this case could be expressed as a definite function of the range. Hours having the same range were collected in groups, and the corresponding mean measured "activities" were plotted as ordinates of a curve of which the abscissæ were the ranges. A regular curve was thence derived, somewhat resembling part of an hyperbola. The work merits the attention of all interested in magnetic disturbance.

Engineering for August 8 contains an illustrated account of experiments on the distribution of wind velocity in the space surrounding a circular rod in a uniform current of air. These experiments were conducted at East London College by Prof. J. T. Morris. The wind velocity was measured by electrical apparatus. Electrically heated wires were attached to the circular rod, and the cooling of these wires by the air current was used as a measure of the wind velocity. The method has been described already by Prof. Morris at the Dundee meeting of the British Association, and at the recent soirée of the Royal Society. The present article gives complete sets of curves showing the wind velocity at different distances from the rod for various speeds of main air current, together with velocity-contour lines for currents of fifteen and five miles per hour. The "shadow" of the rod is brought out clearly by these graphs, and extends much further at low than at high velocity. Judging from the results, the electrical method of measuring air velocities seems to possess considerable advantages in the field of experimental aërodynamics.

THE foreign commerce and navigation of the United States for the year ending June 30, 1912, is dealt with in a volume prepared by Mr. O. P. Austin, and published at Washington by the Department of Commerce and Labour in the United States. The bulky volume of 1342 pages is concerned almost wholly with statistics, and provides detailed information of every department of the trade of the United States. In the fiscal year 1912 the exports of manufactures from the States were larger than in any earlier year in the record of American commerce, and imports of manufacturers' materials also showed larger totals than in any earlier year except 1910. This increasing share which manufactures form in American exports, and manufacturers' materials form in the imports, is chiefly a development of recent years. Manufactures are supplanting foodstuffs as a leading factor in the export trade of the United States. While the value of foodstuffs exported increased from 1885 to 1900, it has actually declined since that date. The percentage which foodstuffs formed of the total exports has declined steadily since 1880; on the other hand, the percentage of manufactures has as steadily increased.

OUR ASTRONOMICAL COLUMN.

RADIAL VELOCITY OF 915 STARS.—Prof. Campbell publishes in Lick Observatory Bulletin, No. 229, a further valuable contribution to the radial velocities of stars secured with the Mills spectrographs attached to the 36-in. refractor at Mount Hamilton, and with the instruments of the D. O. Mills Expedition at Santiago, Chile. Prof. Campbell states that the results for those brighter stars of classes F, G, K, and M, of which the radial velocities appear to be substantially constant, or the approximate systemic velocities may be estimated, including proper-motion and other auxiliary data, relating to nearly 900 stars, have existed in manuscript form ready for the printer for more than a year. It was proposed to issue them in the form as previously published for the stars classes B and A, but want of funds made such a scheme impossible. Even now the necessary means are not forthcoming, so, to avoid further delay, he publishes them in the briefest form in the present bulletin.

All available results for stars of these spectral classes have been included, whether the observations of the same stars have been published or not in former lists; there are also included velocities for a few stars of classes B and A. Results for a few stars obtained at